BLOOMINGTON ABB PLANT SITE

RESULTS OF THE

GROUNDWATER AND SURFACE WATER INVESTIGATION PLAN

NOVEMBER 2010

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1.0 Introduction

This document is the report of results from the investigation required by the U.S. Environmental Protection Agency (USEPA) Administrative Settlement Agreement and Order on Consent For Removal Action at the ABB Plant Site, Bloomington, Indiana (AOC) at Section VIII, Paragraph 16.j. The USEPA conditionally approved the Groundwater and Surface Water Investigation Plan (GWIP) on May 7, 2008 with the proviso that CBS submit to the agency by May 30, 2008, a work plan to conduct dye tracing.

Based upon the results of the GWIP, a long-term groundwater monitoring plan is to be developed according to Section VIII, Paragraph 16 j of the AOC to ensure that groundwater and surface water have not been affected by contamination from the former capacitor plant.

The groundwater and surface water investigation has been concluded and this document fulfills the requirement to report the results of that investigation. Most of the data from the elements of the GWIP have already been reported in interim transmittals. This report provides a summary and compilation of all data generated.

1.1 Site History

Figure 1 shows the location of the ABB site on the USGS 7.5 minute Bloomington, Indiana topographic quadrangle of 1966 (photo-revised 1986). Before the plant was built, based on historical aerial photos and topographic maps, a horse race track and airport occupied the site. It is unlikely that these activities could have contributed any site contaminants. The race track and airport were likely placed at this spot because the land was relatively flat and not pock marked with sinkholes. Site runoff was via surface drainage to the north toward west and east branches of Stout's Creek, and the south toward Sinking Creek, as shown on Figure 1.

In 1958 Westinghouse Electric Corporation constructed and began operation of the Distribution Apparatus Division manufacturing facility at 300 North Curry Pike, Bloomington, Monroe County, Indiana. At the plant Westinghouse produced electrical equipment for the transmission and distribution of electrical power. Among the equipment produced at this facility were reclosers, breakers, lightning arresters, line traps, potential devices, switches, fuse cutout components and electrical capacitors. Between 1958 and 1976, Westinghouse used a substance with the brand name Inerteen as a dielectric fluid inside the capacitors. This dielectric fluid contained polychlorinated biphenyls (PCBs), primarily Arochlor 1242, but also Arochlor 1232 and Arochlor 1016.

Westinghouse discontinued its use of PCBs in 1977 and substituted isopropyl biphenyl under the trade name Wemcol, a non-PCB dielectric liquid which is unregulated. At that time, the plant underwent extensive decontamination of equipment, piping, and facilities. In 1979 a replacement sanitary sewer system was built above the old system and in 1989 the roof drains were modified to reroute the drains from the north of the plant to the south of the plant.

In February 1989, Westinghouse entered into a joint venture with Asea Brown Boveri (ABB) to jointly operate the Bloomington plant. Westinghouse and ABB operated the plant jointly through December 1989, when ABB exercised its option to purchase the facility and business. After January 1, 1990, ABB became the sole owner of the facility.

From 1977 through 1981, several sampling actions were undertaken near the plant. The analytical results of these samples revealed elevated PCB concentrations in a ditch located north of the plant. In 1986, the Indiana Department of Environmental Management (IDEM) performed a preliminary assessment of the area. In 1988, IDEM, USEPA, Technical Assistance Team (TAT) and a Westinghouse contractor, ATEC Environmental Consultants, conducted additional sampling at the site. Analytical results of the samples showed elevated levels of PCBs in soils at the plant property and in onsite water samples.

On May 3, 1989, the USEPA, issued a Unilateral Administrative Order to Westinghouse Electric Corporation pursuant to Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The order required the removal of PCB impacted soil and material at the plant site. These removal activities were completed in 1993.

Substantial PCB sampling and cleanup activities were again performed in the early 1990s in conjunction with ABB's renovation of the inside of the facility, including cleaning and sealing of the concrete floors.

Westinghouse performed an extensive sampling program on the outside drainage courses in the vicinity of the plant in 1989, 1990 and 1991, in response to the USEPA order. Elevated PCB concentrations in nine on-site areas were confirmed. The sampling also identified that soil in the north drainage ditch was impacted with trichloroethylene and tetrachloroethylene.

Nine areas were targeted for PCB removal, including the north drainage ditch, the retention pond on the east side of the plant and the south retention pond. Excavated material subject to disposal under the Toxic Substance Control Act (TSCA) was placed in an interim storage facility at the site. In 1995 Westinghouse sent that material for permanent disposal to a TSCA-permitted landfill located in Grayback Mountain, Utah.

ABB conducted three subsurface investigations inside the plant from 1998 through 2000 to determine whether past manufacturing operations may have affected the sub floor soil with PCBs. Elevated levels of PCBs exceeding 50 ppm were identified beneath the former Kinney ovens in the F30 capacitor processing area, in a testing laboratory, under a sanitary sewer line pipe trench oriented east to west along the northern edge of the F30 area and under a roof drain pipe trench running south to north through the F30 area. Sample results were summarized in the July 17, 2003 report "Previous PCB Soil Investigations and Recommendations for Further Study" by PSARA Technologies, Inc. In conjunction with the 1998 F30 shallow soil sampling event, concrete chip samples were found to contain PCBs at concentrations exceeding 50 ppm.

Manufacturing operations ceased at the plant in 1998. ABB demolished the plant buildings in 2006. The concrete floor slab of the plant was left in place to act as a cap over the contaminated soils underneath.

The Administrative Settlement Agreement and Order on Consent for Removal Action, Docket No. V-W- 08-C-890 (AOC) was issued on January 3, 2008. This order required removal of the concrete slab and underlying contaminated soil. Subsequent testing of concrete and soils was carried out and a work plan was approved by the USEPA in June 2009. From July to December 2009, remediation of the remaining concrete and soils was carried out.

The lateral and vertical extent of contamination of concrete and soil had been generally established based on previous investigations conducted at the site. Following removal of all contaminated concrete and soil in the main plant area and the completion of successful verification sampling demonstrating that clean-up levels had been met, the site was backfilled. The site was final graded and seeded in the summer of 2010.

Specific objectives of the remediation were:

- The demolition, removal, transportation, and disposal of Toxic Substances Control Act (TSCA) and Special Waste concrete
- Excavation of TSCA, Special Waste, and Resource Conservation and Recovery Act (RCRA) soils and verification sampling associated therewith
- Onsite stockpile sampling of RCRA characteristic soils
- Onsite treatment of RCRA characteristic soils for reuse as onsite backfill
- Transportation and offsite disposal of TSCA and Special Waste soils
- Construction of an approximately 23,000-cubic-yard borrow pit on site to provide backfill material for completed soil excavations and final site restoration
- Onsite reuse of sized low level PCB concrete (<35 ppm maximum) as structural fill in the borrow pit
- Collection, testing, storage, and treatment of water during remediation
- Diversion of storm water around active excavations
- Collection, testing, storage, and treatment of storm water and ground water encountered in active excavations
- Air monitoring during removal, stockpiling, and handling of TSCA concrete and TSCA soil
- Site restoration and project closeout

As a result of the remediation conducted, CBS and ABB performed the following:

- 38,222 tons of TSCA soil in 1,590 truckloads was shipped to the Heritage Roachdale Subtitle C Landfill
- 236 tons of TSCA solidified sludge in 9 truckloads was shipped to the Heritage Roachdale Subtitle C Landfill
- 3,840 tons of TSCA concrete in 169 truckloads was shipped to the Heritage Roachdale Subtitle C Landfill
- 2,569 tons of special waste soil in 152 truckloads was shipped to the South Side Subtitle D Landfill
- 116 tons of special waste concrete in 6 truckloads was shipped to the South Side Subtitle D Landfill
- 433 tons of solidified sludge in 22 truckloads was shipped to the South Side Subtitle D Landfill
- 398 tons of petroleum soil and gravel in 22 truckloads was shipped to the South Side Subtitle D Landfill
- 8 stockpiles in the SVE system were processed for re-use as backfill on site
- 7 stockpiles in the SVE system were processed to be shipped as TSCA
- 1,415,500 gallons of water were treated to < 0.3 ug/L PCBs for discharge to the site NPDES pond
- 23,000 cubic yards of clean clay from the onsite borrow pit were used as backfill at the site

Post remediation residual contaminant levels achieved are as follows:

- The arithmetic average of all residual PCB sample results from 0 to 7 feet in 9 release areas varied from 0.7 to 3.8 ppm, compared to the 10 ppm allowable average under the AOC.
- The arithmetic average of all residual PCB sample results greater than 7 feet deep in 9 release areas varied from 1.1 to 6.5 ppm, compared to the 25 ppm allowable average under the AOC.
- The arithmetic average of all residual tetrachloroethene (PCE) sample results in 6 release areas varied from 0.4 to 3.5 ppm, compared to the not to exceed 7 ppm allowable average under the AOC.
- The arithmetic average of all residual trichloroethene (TCE) sample results in 6 release areas varied from 0.4 to 1.0 ppm, compared to the not to exceed 5 ppm allowable average under the AOC.
- Two release areas, the Coupling Capacitor area and the Test Lab, required 95% UCLs to be calculated. Results were well below the IDEM RISC industrial migration to groundwater closure guidelines.

ABB left a concrete consolidation area paved over with asphalt. The concrete consolidation area may hold water and the average PCB content of the concrete is 5.6 ppm.. CBS found DNAPL deep against bedrock in several locations in the southwest portion of the building. The DNAPL tainted soils were removed and the soil excavations were backfilled in compacted lifts. Geotechnical engineers confirmed with testing that the compaction was carried out to specifications.

1.2 Groundwater Investigation Plan Purpose (GWIP) and Requirements

The AOC also required a Groundwater Investigation Plan for the site. The purpose of the GWIP was two-fold:

1. To determine if area springs received site related contaminants.
2. To determine if any residential wells still in use between the site and the area springs received site related contaminants.

To accomplish the purpose the following tasks were defined:

1. Sample area springs for site related contaminants during non-storm conditions for at least four quarters (six quarterly samples were eventually taken).
2. Sample any spring that showed site related contaminants during a storm event of at least 1" magnitude.
3. Sample sediments downstream of any area spring that showed site related contaminants during quarterly sampling.
4. Conduct a dye trace test from the site and determine if any area springs received dye from that trace.
5. Inventory all residences and businesses between the site and any area spring receiving site related contaminants for water supply wells in use and sample any wells found for site related contaminants.

1.3 Amendments to the Groundwater Investigation Plan

In Section **6.1.4, Define Boundaries of Study,** of the GWIP the physical limits of the boundaries of investigation were to be, spatially, the spring(s) to which site groundwater may discharge. The springs in the site area had been identified as a result of studies associated with other Bloomington area PCB sites. These springs had been sampled in the past for at least PCBs.

CBS had conducted detailed dye testing work done for both the Lemon Lane Landfill (about one mile to the east of this site) and Neal's Landfill (about two and one-half miles to the west of this site). Based on this dye testing experience within the Mitchell Plain, and extensive follow up with contaminant monitoring, it has shown that the most likely springs to receive groundwater from a site near a ridge-top are the nearest head-of-valley outlets, usually within a mile of the site. Additionally, the elevations of the springs which receive site groundwater are generally within 15 feet of the typical phreatic groundwater elevation in the bedrock at the site.

Initially, the springs identified to be investigated were:

- Detmer
- Robertson
- Stony West
- Jack's Defeat East
- Jack's Defeat West
- Cave Creek Headwaters
- Snoddy
- Sinking Creek

During the first quarterly sampling event for the Bloomington ABB springs that occurred on July 15, 2008, the original location of Jack's Defeat Creek East spring emergence was found to be dry. The creek was subsequently sampled at the crossing of Loesch Road just before its confluence with the west branch as shown on Figure 2. It was agreed that CBS and PSARA Technologies, Inc. would perform reconnaissance from the sample location back upstream to the original location in order to locate any possible spring resurgences. That reconnaissance was conducted on August 6, 2008, by Mike McCann of CBS and Neill Vaughan of PSARA. Details of that reconnaissance are shown in Attachment 1. Figure 3 shows the location of Worker Spring and Mobley Springs 1&2, which by agreement with the USEPA became the amended location to sample Jack's Defeat Creek East. In a similar manner it was discovered that the Jack's Defeat Creek West perennial spring location was on Loesch Road just past the intersection with Old Vernal Pike. Map details and photos of this spring location are shown in Attachment 2.

The Snoddy Springs area was found to have two resurgences that were both sampled as was the Stony West Springs. Robertson Spring was discovered not to be a spring, but a resurgence of Stout's Creek West Branch water in the creek bed. Robertson Spring is fully discussed in a subsequent section of this report. Figure 4 shows the amended spring location map for which the remainder of the investigation was conducted which includes:

- Detmer Spring
- Worker Spring
- Mobley Springs 1&2
- Loesch Road Spring
- Stony West A Spring
- Stony West B Spring
- Cave Creek Headwaters
- Snoddy A Spring
- Snoddy B Spring

Sinking Creek Headwaters (Figure 4) was not included in the contaminant sampling schedule because it was the NPDES sampling point for the ABB Corporation and was sampled under those requirements. It was included as a sampling point for the site dye trace as discussed below.

2.0 Robertson Spring Dye Trace

2.1 Background

In the preparation of the Groundwater and Surface Water Investigation Plan for the ABB Bloomington Plant Site, reconnaissance was conducted of potential spring resurgences in the area. During the reconnaissance of Robertson Spring on November 19, 2007, the Stout's Creek Channel above the spring was noted to be dry and the spring was the first appearance of water. Approximately 200 feet upstream of the spring resurgence, Stout's Creek was observed disappearing into its bed. During reconnaissance on April 17, 2008, there was continuous flow in the channel, however Stout's Creek was observed to lose about half its flow at the same location upstream and the flow seemed to be regained at the Robertson Spring discharge.

These observations led to the suspicion that Robertson Spring is not true groundwater resurgence but rather the resurgence of creek water lost to the bed upstream. It was agreed by the parties of the Bloomington ABB project that if Robertson Spring was not a true spring, it should be eliminated as a monitoring point for all future groundwater sampling events and any dye traces run from the ABB Bloomington site.

The parties agreed to conduct a visual dye trace from where the creek is disappearing into the channel bed to see if that water resurges at Robertson Spring.

2.2 Task Plan

The original task plan for the dye trace called for the following steps to be taken:

- Flow conditions for testing should be no flow in the Stout's Creek Channel immediately upstream of Robertson Spring.
- Prepare 250 ml aliquot of 50% strength solution of Fluorescein (Acid Yellow 73).
- Make estimations of flow above and below the resurgence with velocity probe.
- Take one sample of water above and below the resurgence for background fluorescence on a scanning spectrofluourometer.
- Take one sample of old Robertson Spring if flowing for background fluorescence on a scanning spectrofluourometer.

- Pour the dye aliquot into Stout's Creek where it disappears into the channel bed.
- Observe spring resurgences for visible presence of dye and photograph any visual resurgence. If no dye is observed at the new Robertson Spring location within 12 hours after pouring the dye in the channel, then take a sample of spring water for analysis of dye and secure the event. Analyze the water sample for dye on a scanning spectrofluourometer.
- If visible dye is observed at the new Robertson Spring location, take a confirmation sample of spring water, when dye is observed, for analysis on a scanning spectrofluourometer.

2.3 Results of Dye Trace

The flow conditions for the test were met on August 8, 2008, when flow was sinking into the Stout's Creek bed about 200 feet upstream of the new Robertson Spring location. Photographs of the dye trace can be seen in Attachment 3. Photo 1 shows the Robertson Spring before dye injection and photo 2 shows the upstream sinking of Stout's Creek before injection. Photo 3 shows the old Robertson Spring location which was completely dry. Flow measurements of upstream Stout's Creek was about 40 gpm while downstream of the spring resurgence measured about 65 gpm. The margin of error on these shallow bed low flow measurements is 20-30%.

Fluorescein dye (CI Acid Yellow 73) consisting of 250 ml of 50% solution was poured into Stout's Creek, as shown in photo 4, at 09:00 hours. Within 15 minutes the dye was brightly visible in all the Robertson Spring outlets as can be seen in photos 5, 6, and 7. Since the dye quickly and unambiguously appeared at the Robertson Spring location, with the agreement of John Bassett, USEPA contract observer, no background fluorescence or confirmation samples were run on a scanning spectrofluourometer.

There may be a minor amount of local soil water or top of rock seepage that is gained from where Stout's Creek sinks to where it emerges based on the flow measurements, or there may have been additional bed losses upstream of where the upstream flow measurement was made. In any event, the conclusion is reached that Robertson Spring is not a true groundwater resurgent spring but is re-emerging creek water. The rapidity that the dye pulse traversed the 200 foot section indicates the water followed an open fracture in the top of rock rather than filtered through the gravel. Such phenomena are common in the small streams around Bloomington and Monroe County in the limestone bedrock and are common in many karst terrains. Robertson Spring was dropped from further sampling in connection with the Bloomington ABB site.

3.0 Dye Trace from ABB Bloomington Plant Dye Injection Wells

3.1 Introduction and Scope of Work

The initial GWIP did not contain a plan for conducting a dye trace from the plant site. However, in responding to comments on the GWIP by the USEPA, CBS and ABB agreed to develop a work plan for a dye trace from the site. This resulted in a May 7, 2008 letter from Thomas Alcamo of the USEPA approving the GWIP contingent upon the submittal of a dye trace work plan. A Scope of Work (SOW) was developed to conduct such a dye trace.

An initial SOW covering the following work tasks was completed, followed by an amended SOW:

- Reconnaissance of springs (described in Section 1.3 above)
- Robertson Spring dye trace (described in Section 2.0 above)
- Installation and testing of dye injection wells

The results of the completion of these tasks and the subsequent amendment of the SOW are discussed below. The final amended SOW is included in Attachment 4. The initial SOW is included as an attachment in the final SOW.

It was agreed that CBS would install injection wells. A SOW for the installation of the dye injection wells was included in the dye trace SOW in Attachment 4. The wells were to be located after a review of surface lineament features using aerial photography. The wells were located to the north of the concrete slab at the site.

3.2 Dye Injection Wells

The SOW for the installation of the three dye injection wells (DIW) is included in Attachment 4. The dye injection wells were located about 100 feet north of the slab and about 100 feet apart beginning with the first well located about 100 feet west of PZ-15. The dye injection wells were advanced to bedrock by use of a hollow stem auger and then an air-percussion bit was used to advance the hole 10 feet into bedrock. Details of the injection wells and their development and testing can be seen in Attachment 4.

Table 1 shows the results of sampling the three dye injection wells for site-related contaminants. The accompanying lab certificates of analysis are included in Attachment 4. DIW #3 had a number of site-related VOCs, including a 490 µg/l PCB result. DIW #1 was chosen as the injection well for the dye test because it had an acceptable rate of flushing, as DIW #2 did not, and less concentrations of site-related contaminants than DIW #3.

3.3 Background Sampling and Results

Based on the final SOW for Dye Tracing, official results of dye tracing are considered to be the charcoal samples analyzed and reported by Ozark Underground Laboratories (OUL). CBS for its own informational purposes elected to conduct additional grab water samples and analyze them with its Turner Designs Picofluor Handheld Fluorometer Model 8000-004. Details of the filter fluorometer and are given in Attachment 4.

Table 2 shows all the filter fluorometer analyzes of the grab water samples. The background samples show dates of 1/21/09, 2/9/09, 2/12/09, and 2/16/09. The 2/12/09 samples were those taken following a greater than 1 inch rain that fell in the Bloomington area. The background grab water sample results indicate that Fluorescein would be a suitable dye for use as a tracer as it was not detected in high background concentrations.

Table 3, Results of Background Sampling of Charcoal Packets, shows the results of the background sampling of the charcoal packets for 1 day, 2 days, 4 days, and 7 days exposure as per the SOW. Since greater than 1 inch rain occurred February 11-12, the SOW requirement of a background rain event of that magnitude or greater for sampling was fulfilled.

The results show no detectable background for Eosine and Rhodamine WT dyes. There were low levels but detectable background concentrations near the Fluorescein peak in Stony West A Spring, Stony West B Spring, Detmer Spring, Snoddy A Spring, and Snoddy B Spring. These results indicate that Fluorescein would be an acceptable dye to be used for the dye trace. The results also set the limit for positive dye detection as 10 times these background results.

3.4 Dye Injection

The SOW for the dye trace in Attachment 4 called for certain hydrologic conditions to be met before dye injection could begin. Specifically, the SOW called for hydrologic conditions for the dye injection should be moderate to moderately high flows defined as Illinois Central Spring at the Lemon Lane site flowing at 100-300 gpm

It was also informally agreed among the parties that the Snoddy A and B Springs would be flowing at least at the start of the test. A 0.75 inch rain event on March 29, 2009, caused the hydrologic conditions to be met. A dye injection was scheduled for March 30, 2009. Fresh charcoal samplers were placed at all the monitoring locations the morning of March 30th.

Per the agreed work scope, CBS prepared 2 liters of the 50% as-received solution (Chromatech, Inc., D11006 Chromatint Uranine HS Liquid, Lot # 10703D) of Fluorescein dye. Figure 5 shows the dye injection being accomplished. Clean water was flushed into DIW #1 at the approximate rate of 1 gpm. After 20 gallons of water were flushed, the dye was introduced at the top of rock via a peristaltic pump and was complete by 11:00 hours. The remainder of the water was then flushed into the well at 1 gpm. The next day a bailer sample was withdrawn from DIW #1 and the residual dye concentration was estimated by the CBS filter fluorometer to be 13,000 ppb. Although this indicated that more than 50% of the dye had exited the well bore, another 100 gallons of clean water was flushed at a rate of 1 gpm. After the second flush of 100 gallons, the dye injection was considered complete.

3.5 Resurgence Monitoring and Results

3.5.1 Grab Water Sample Filter Fluorometer Results

An autosampler was programmed to begin taking grab water samples at Detmer Spring beginning at 12:00 hours on March 30th, and continuing every two hours until April 2nd, at 12:00 hours. Table 4 shows the results of those samples and Figure 6 is a plot of those results. Based on the filter fluorometer results, the dye begins appearing at Detmer spring by 0800 hours on March 31, or 20 hours after injection. The straight-line distance form DIW #1 to Detmer spring is 2,950 feet, so a straight-line groundwater flow velocity would be 147.5 feet per hour or 2.5 feet per minute. This flow velocity clearly indicates open conduit flow and is comparable to both Lemon Lane and Neal's Landfill karst spring flow systems at comparable flow regimes.

Table 2 shows the results of grab water sampling conducted as the charcoal samples were collected. The samples show the dye was detectable by the filter fluorometer at Detmer Spring throughout the month of April. The filter fluorometer grab water samples did not indicate the resurgence of dye at any other spring above background.

3.5.2 Charcoal Sample Results

Tables 5 through 12 contain the results of the OUL analysis of the charcoal samplers. Table 5 contains the results for the 1, 2, 4, and 7 day samplers. The samplers at Detmer Spring are conclusively positive for the Fluorescein dye. In Tables 6 through12 each weekly Detmer Spring sampler is positive for Fluorescein, indicating a slow residual leakage of dye from the injection site.

The injected dye was only detected at Detmer Spring throughout the sampling period of the test. No residual dye was mobilized to any other spring during the two month monitoring period which is conclusive evidence that Detmer Spring is the only resurgence point for the injected dye.

3.6 Conclusion

A dye test was conducted from an injection well at the top of bedrock just north of the concrete slab at the Bloomington ABB Plant site. The dye injected, Fluorescein (Acid Yellow 73), was conclusively detected at Detmer Spring, a straight-line distance of 2,950 feet north of the injection well at the head of the West Branch of Stout's Creek. Analysis conducted by a filter fluorometer of grab water samples indicated the first appearance of the dye occurred about 20 hours after injection. Residual dye continued to manifest at Detmer Spring throughout the 57 day post-injection monitoring period. No other spring showed any indication of the Fluorescein dye that was injected, despite several storm events that occurred during the post-injection monitoring.

4.0 Quarterly Spring Sampling

4.1 Requirements

Based on the requirements of the GWIP, all the springs were sampled quarterly for one year during non-storm conditions (no rain greater than a cumulative total of .25 inches for 72 hours prior to sampling) to cover all seasons. Additionally, if any spring showed site contaminants above the detection limits, then those springs should be sampled during at least one storm event for site contaminants. Those springs which showed PCBs above reporting limits will also have the sediments downstream of the spring sampled for PCBs. Storm sampling and sediment sampling are discussed in the sections following this one.

Quarterly non-storm samples were analyzed for PCBs in water using SW-846 method 8082 for Aroclor PCBs. The estimated detection limit for this analysis was 0.1 ppb. If any two of the quarterly non-storm samples show PCBs above 0.1 ppb, then a storm event was to be sampled at that spring. Similarly, the sediments were to be sampled if any of the non-storm samples show PCBs above 0.1 ppb. See discussion in subsequent sections.

For VOCs in spring water, SW-846 method 8260 was used. The VOCs to be analyzed were those that were found in the soils on site as listed in Table 13. The nominal reporting limit for most VOCs from this method is 5 ppb. The actual list of reporting limits from the lab are shown on Table 13 along with the amounts found in soils at the site and the IDEM RISC Migration to Groundwater standards for industrial and residential. If any of the VOCs potentially derived from the site were detected above the lab reporting limit, then that spring was to be sampled during a storm event, as discussed below.

The springs that were sampled included:

- Detmer Spring
- Worker Spring
- Mobley Springs 1&2
- Loesch Road Spring
- Stony West A Spring
- Stony West B Spring
- Cave Creek Headwaters
- Snoddy A Spring
- Snoddy B Spring

The Sinking Creek location was not sampled as it was the NPDES location for the ABB Plant and was handled under those requirements.

4.2 Methodology

For non-storm water samples, PCBs and VOCs were sampled per FP-4 using grab samples. The samples were taken during non-storm conditions which were defined as no rain on the day of sampling and no more than 0.25 cumulative inches of rain in the past 72 hours prior to sampling. Each PCB grab sample was a 1 liter sample analyzed using SW-846 8082 with a reporting limit of .1 or .2 ppb. Each VOC sample was taken in 40 ml VOC vials and analyzed for VOCs using SW-846 8260b. The reporting limits vary (for example for TCE and PCE the reporting limit is 5 ppb) and are listed in Table 13. All samples were analyzed at Heritage Labs in Indianapolis.

4.3 Results of Quarterly Spring Sampling

In all, six quarters of samples were taken of the springs, beginning in July 2008 and continuing through January 2010. No quarterly sample was taken in the first quarter of 2009. A complete list of results of all six quarters of sampling including field notes and lab certificates are in Attachment 5. No site related contaminants were found at any sampling location other than Detmer Spring in all six quarters. Table 14 shows the summary results of sampling at Detmer Spring. PCBs were detected in each sampling event either as Aroclor 1242 or as Aroclor 1248. The PCB concentrations ranged from 0.12 µg/l to 0.24 µg/l. Tetrachloroethene (PCE) was found ranging from 7.1 µg/l to 26 µg/l and trichloroethene (TCE) was found ranging from 6.7 µg/l to 26 µg/l. Also found were 1,1-dichloroethene BDL-15 µg/l, cis-1,2-dichloroethene BDL-11 µg/l, and 1,1,1-trichloroethane BDL-5.7 µg/l.

Based on these results, storm sampling and sediment sampling was scheduled for Detmer Spring only, as discussed below. Detmer Spring drains into the West Branch of Stout's Creek. Although the USEPA maximum contaminant limit for the VOCs detected in Detmer Spring is 5 µg/l in each case, no use of Detmer Spring or the West Branch of Stout's Creek is made for drinking water so any concern would be ecological. None of the VOCs are found at levels above the IDEM criteria for protection of aquatic life. PCBs are found at levels generally below what is required for treatment standards for PCBs (0.3 µg/l). The levels of site related contaminants detected at Detmer Spring were consistent with historical data from the spring. The levels did not appear to change over the course of the remediation period.

5.0 Detmer Storm Event Sampling

5.1 Requirements for Storm Sampling

The GWIP, Section 6.1.7 requires that any spring related to the site that shows detectable levels of polychlorinated biphenyls (PCBs) or site-related volatile organic compounds (VOCs) after at least four quarters of non-storm flow sampling will be sampled for those same analytes during a storm event.

Only Detmer Spring had detectable levels of PCBs and/or site-related VOCs during all six quarters. Therefore, Detmer Spring alone was sampled during a storm event.

5.2 Storm Sampling Methodology

The GWIP, Section 6.1.7, page 20-21 states that:

> Storm sampling will be done during a storm event with a cumulative rainfall of 1 inch or more. The first storm sample will be taken just before or within 1 hour of the start of rain and then grab samples will be taken every 4 hours until 12 hours beyond the stop of rain.

After non-storm sampling had confirmed that Detmer Spring was the only spring to be storm sampled, preparations were started to accomplish the event. An autosampler was set up at Detmer Spring to sample with 500 ml bottles every hour for PCBs. A pressure transducer was installed so that relative water levels could be recorded as staff levels.

A rain event began on April 7, 2010. The online record of the National Weather Service recorder at the Bloomington Airport showed light rain beginning between 18:53 and 19:53 hours with 0.05 inches accumulating, the main rain occurring by 20:53 with 0.79 inches accumulating, and concluding by 3:53 hours on April 8, 2010, with a total of 1.67 inches (Attachment A). The rain gauge operated by PSARA at the 2002 West Vernal Pike office recorded light rain of 0.06 inches accumulating by 19:45 hours and the main rain event of 0.32 inches total accumulation by 20:15 hours. The PSARA gauge recorded a total of 1.56 inches ending at 3:15 hours on April 8, as shown on Figure 7.

The first grab sample for VOCs was taken at 21:10 hours on April 7, 2010. This was within an hour of the start of the main mass of precipitation. Grab samples for VOCs were taken every four hours on the hour until 17:00 hours on April 8. If the end of rain is taken to be about 04:00 hours on April 7, then sampling for VOCs was terminated 13 hours after the end of rain. Four 40 ml VOC vials were taken at each grab event. Table 15 lists the times, sample type (composite or grab and QA/QC), parameter, sample identification number, volume collected, field conductivity (for PCB samples only), number of bottles, bottle size and analytical results.

The autosampler for the PCB samples was started at 21:10 hours on April 7, and thereafter collected on the hour. It was decided in consultation with the USEPA representatives to composite the hourly PCB auto samples in four hour increments in order to maintain the lower detection limit of 0.1 µg/l and retain enough sample to conduct total suspended solids analysis (TSS) as well (see Table 1). The last PCB composite was taken at 16:00 hours on April 8, 12 hours or more after the rain ended. The autosampler inner chamber was kept filled with ice contained in zip-loc bags. A duplicate sample for VOCs was taken April 8 at

09:00 as AB0080. A single grab sample was taken for PCBs on April 8 at 13:00 as AB0083 and a duplicate grab was taken at that time as AB0084. At the same time a blank for PCBs was taken as sample AB0085. A blank sample for VOCs was taken April 8 at 17:00 as AB0088. All samples were transported cooled on ice as per procedures to Heritage Labs via courier. PCB and VOC sample analysis was performed via EPA SW-846 method, the list of VOC analytes were limited to those found in the soils at the ABB plant site.

5.3 Results of Sampling

Table 15 lists the sample results. Lab certificates are in Attachment 6. All VOCs were below the detection limit (BDL) except for the April 8 sample at 17:00 that had 5.2 µg/l tetrachloroethene. PCBs ranged from a high of 0.35 µg/l near the peak flow in the channel (see Figure 7) to a low of 0.10 µg/l on the duplicate grab sample of April 8 at 13:00. The highest PCB result was also associated with the highest TSS result which may indicate scouring of surface or subsurface channels. The PCB results are comparable to storm event sampling conducted by an EPA contractor in April 2003 as shown in Table 16, which was also Table 4 in the GWIP.

The pre-storm flow at Detmer Spring was visually estimated to be about 30 gallons per minute (gpm). An estimate of peak flow was about 1,000 gpm with most of the water observed to be surface runoff from above the spring. Surface flow in the channel had ceased by 10:00 on April 8 and the post-storm flow of the spring was estimated to be about 40 gpm.

6.0 Detmer Sediment Sampling

6.1 Requirements

The GWIP, Section 6.1.7 requires that any spring related to the site that shows detectable levels of polychlorinated biphenyls (PCBs) or site-related volatile organic compounds (VOCs) after at least four quarters of non-storm flow sampling will have sediment samples taken downstream of the resurgence.

As noted in Section 5, CBS actually took 6 quarterly samples from all the springs shown in Figure 4. The sample results showed that only Detmer Spring had detectable levels of PCBs and/or site-related VOCs during any quarter. Therefore, the stream reach downstream of Detmer Spring was the only stream to have sediment samples taken.

6.2 Sediment Sampling Methodology

The GWIP, Section 6.1.7, page 21 states that:

> Sediment samples will be taken in the west branch of Stout's Creek for the first 500 feet downstream of each spring. The samples will be taken per FP-4. Each sediment sample will be a composite of 5 surface grabs (0 to 3 inches). Each composite will represent a 100 foot reach of the stream. The grabs will be taken every 20 feet, with 5 consecutive grabs then composited to represent a 100 foot reach. Sampling will begin at the most downstream location. Since this branch of Stout's Creek is very shallow, the grabs will be taken with a scoop or gloved hand. The composites will be analyzed for PCBs on a dry basis using SW-846 8082 with a detection limit of .1 ppm. All samples will be analyzed at Heritage Labs in Indianapolis.

After non-storm sampling had confirmed that Detmer Spring would be the only spring to be sediment sampled, preparations were started to accomplish the event. A reconnaissance of the stream reach took place on April 1, 2010, with a representative of the USEPA present. It was discovered that the first 500 feet of stream reach contained many stretches of exposed bedrock riffles and gravel deposits that were not deemed suitable for collecting representative sediment samples. The search for acceptable sampling reaches was expanded to approximately 1,200 feet downstream and 5 mutually acceptable reaches for sampling were located.

The beginning and end of each reach is shown on Figure 8 and Table 17 gives a brief description of each reach with beginning and ending GPS coordinates given as UTM northing and easting in meters. It was agreed that each reach would have 5 grab samples taken equidistant from each other in the reach with each grab being representative of the sediment type in the reach. These five grab samples were composited into one sample representative of each reach.

Sampling began at the downstream end of Reach 5 and proceeded upstream on May 6, 2010. Sampling was conducted per FP-4 and the grab samples were taken with a gloved hand. Sample information and descriptions are given on the field log sheets in Attachment A. The composites were analyzed for PCBs on a dry basis using SW-846 8082 with a detection limit of 0.1 ppm. All samples were analyzed at Heritage Labs in Indianapolis. A duplicate sample was submitted for Reach 3.

6.3 Results of Sampling

Table 18 lists the sediment analytical results for PCBs and total organic carbon. Lab certificates are in Attachment 7. PCBs ranged from a high of 2.4 mg/kg in Reach 5 (see Figure 2) to a low of 0.33 mg/kg on the duplicate composite sample of Reach 3. The highest PCB result was also associated with the highest organic carbon result. The flow at Detmer Spring was visually estimated to be about 60 gallons per minute (gpm) or less.

7.0 Residential Well Inventory

7.1 Requirements

The GWIP required a work plan to identify potentially impacted residential groundwater well users. The general procedure for the survey is found on page 21 of the GWIP and included the following:

1. Identify a 5,000 foot radius from the property boundary of the site.
2. Locate previously identified residential wells on the map which fall within the 5,000 foot radius. Previous surveys were performed in 1990 and 1995 for the Lemon Lane site.
3. Obtain the State of Indiana residential well locations from the state data base for the site area and plot those wells within the 5,000 foot radius.
4. Obtain the latest city water line maps and locate the water lines within the 5000 foot radius.
5. Using the results of the 4 quarters of spring sampling, identify which springs are potentially receiving groundwater from the site.

6. Identify all homes within the area between the site and the identified spring(s) that are down gradient of the site. Match the homes with the known wells and city water line availability.
7. Contact the residents of any home that is apparently down gradient of the site and was known to have a well or if the house is not known to be served by city water. Determine the existence or status of any well at that location.
8. If a well is still in use and potentially down gradient of the site, then sample the well for PCBs and VOCs.

Items number 1, 2, 3 and 4 were completed in the GWIP and are shown on Figure 6C and Appendix B and D of the GWIP, which are included in Attachment 8.

7.2 Determination of Downgradient Springs and Potential Residential Areas

As described in Section 5, six quarters of spring sampling was conducted from July 2008 to January 2010. The only spring to show detectable levels of site-related contaminants was Detmer Spring. Figure 4 shows the location of the springs sampled. This was also confirmed by a dye trace conducted beginning March 30, 2009, from a dye injection well drilled on the former plant property. Only Detmer Spring received dye injected from the site. The results of the dye trace were reported to the EPA in a document dated June 2009, and are discussed above in Section 4.

Figure 9 shows the dye injection well and the dye injection trace to Detmer Spring. A strict interpretation of potential downgradient areas between the site property and the spring is also shown on Figure 9. Only the trailer parks are between the site property and Detmer Spring and all the mobile homes are connected to city water. A larger area was conservatively identified on Figure 9 as potentially downgradient of the site and was the subject of the residential well inventory as agreed to by the USEPA.

7.3 Conducting the Residential Well Inventory

The City of Bloomington maps showing the location of water lines as of 2007 were obtained for the GWIP. These maps show that areas identified as Area #2 and Area #3 in Appendix D of the GWIP are served by city water. For the purposes of this report an updated search of the IDNR Water Well Record database was conducted on February 8, 2010. It is included in Attachment 8 and shows that no new water wells have been drilled in the areas of interest since 1996, as would be expected of an area served by city water.

In June 2010, CBS conducted a door to door survey of the residences and businesses shown on Figure 10, with the exception of the trailer parks. The area inventoried is the potential area downgradient of the site and a water supply inventory sheet was filled out for each residence or business contacted, as shown in Attachment 8.

7.4 Results of the Residential Well Inventory

The results of the inventory are shown in Table 19. Figures 11 and 12 show the residences or businesses address and location. Pamphlets explaining the survey were left and requested that the resident contact CBS. Twenty six residences or businesses were reached and answered the questionnaire concerning their water supply. Three residents had knowledge of former wells that they confirmed were blocked and no longer accessible for use. Fourteen residences did not respond to the survey and could not be reached. CBS

then contacted Customer Service at the City of Bloomington Utilities (CBU) and requested to know if they had billing records for those fourteen addresses. CBU confirmed the addresses had billing records and that correspondence is listed in Attachment 8.

Based on this inventory, it appears that all residences and businesses between the site and the Detmer Spring are served by municipal water and no residential or business wells could be found still in use or accessible for use. Therefore, no residential or business wells are available downgradient of the site to be included in groundwater monitoring associated with the ABB Bloomington Plant Site.